

CONTINUATION IN PART PATENT APPLICATION

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TITLE OF INVENTION

Blank Panel for Rack Units

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REFERENCE TO RELATED APPLICATION

The present Application is a Continuation in Part to the
20 equally titled US Patent Application filed 04/19/2001,
Application Number 09/839,567, which is hereby incorporated by
reference.

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FIELD OF THE INVENTION

This invention relates generally to panels for use with rack
units. More particularly, this invention relates to blank
panels comprised of face plates and means for attachment to
30 open and enclosed electronic rack units.

BACKGROUND ART

Known blank panels for use with electronic rack units are typically composed of face plates having a rectangular cross section with elongated holes positioned in proximity to the outer edges for receiving fasteners to facilitate attachment to rack units. The face plates and associated holes are dimensionally sized and configured to standards set by the Electronic Industries Association (EIA). In EIA Standard RS-310-C the dimensional standards for racks, panels, and associated equipment are specified. Three cabinet and rack widths to accommodate each of three standard panel widths, 19", 24", and 30" are covered by this Standard. 19" is the preferred width. Panel height is defined by the Standard in multiples of Rack Units (RU's). One Rack Unit is defined as 1.75".

Blank panels are typically employed on rack units for either aesthetic or enclosure purposes. A blank panel is often used to keep contaminants (such as dust) out of a rack unit and away from sensitive equipment. Rack units also often employ forced or drawn air ventilation systems to cool components. These systems require a substantially closed system to maintain proper convection flows. Open panels on the front of rack units compromise the effectiveness of these systems. Blank panels are often used to cover vacancies in the front of such rack units.

Blank panels are used extensively in conjunction with various types of rack units. Specific terminology extends to blank plates, blank panels, and face plates among others. Blank panels, as used in the electronics industry, are generally comprised of metal, typically steel or aluminum.

For examples of prior art panels and their methods of attachment to rack units see Peroni in U.S. Pat. No 5,971,507 and Odell in U.S. Pat. No. 5,312,005. The devices disclosed do not illustrate a novel means for attaching panels to a rack unit. The references employ standard elongated orifices positioned near the ends of the panel to accept threaded fasteners. In U.S. Pat. No. 5,992,808 Morrow teaches the use of a "key" for attaching electronic components and panels to rack units. The key has a geometry so as to be insertable through openings on the periphery of a panel, and subsequently through corresponding openings in a rack unit. On rotating the key through 90 degrees the key locks in position, thus securing the panel in place. This method for attaching panels to rack units offers the advantage of not requiring special tools, however, it also requires that the rack unit be modified to lock the keys in the rotated position. A further shortcoming is inherent in the sheer number of individual keys required to attach a single panel to a rack unit, such loose parts are both cumbersome and at risk for loss.

References in the prior art do not discuss a means for directly incorporating fasteners with blank panels. The references also generally require special tools to operate the fasteners which they employ. Further, the prior art does not overcome the limitation of an individual blank panel not being adaptable to accommodate various height requirements.

What is needed is a blank panel that is attachable to racking units in a secure manner, which employs fasteners that do not require the use of special tools or equipment. The fasteners should be easy to replace and accommodate various rack configurations. The blank panel needs to be functional, light weight, modular and versatile. The blank panel should conform to recognized standards for racks, panels, and associated

equipment. It would also be useful if the blank panel could be modified to accommodate varied height requirements.

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OBJECTS AND ADVANTAGES

Accordingly, it is a primary object of the present invention to provide a blank panel that can be securely attached to
10 electronic component rack units.

It is a further object of the invention to provide a blank panel for rack units that is attachable without the use of special tools.

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It is a further object of the invention to provide a blank panel for electronic component rack units comprising at least one face plate with means for slidably receiving fasteners.

20 It is a further object of the invention to provide a blank panel for electronic component rack units, wherein the blank panel comprises a plurality of face plates capable of covering multiple adjacent openings.

25 It is a further object of the invention to provide a blank panel for electronic component rack units incorporating a plurality of face plates, wherein individual face plates of the blank panel are modular and can be separated to configure the blank panel to varied height requirements.

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SUMMARY

The objects and advantages of the invention are accomplished by a blank panel that is configured to be attachable to a rack unit. The blank panel generally comprises at least one face plate having a substantially rectangular front plate surface, a
5 back plate surface, top plate surface, bottom plate surface and two side plate surfaces. The face plate has a height preferably corresponding but not limited to multiples of 1.75 inches. The face plate is capable of slidably receiving fasteners for being further attached to an electronic component
10 rack unit.

Fasteners are incorporated to mate with the face plate of the blank panel and be attachable to electronic component rack units. The fasteners are configured to securely attach to
15 electronic component rack units with alternate configurations substantially without use of assembly tools.

In a preferred embodiment of the invention, the blank panel is comprised of a plurality of face plates held together along
20 their length with break-off grooves that provide for a manual separation of individual face plates and at the same time warrant sufficient structural strength for the blank panel.

The components of the blank panel are preferably monolithically
25 fabricated of a polymer for light weight and durability. Optional glass fiber or the like may be added to the polymer to increase the blank panel's stiffness and/or to modulate a break-off characteristic of the break-off grooves.

BRIEF DESCRIPTION OF THE FIGURES

- 5 **Fig. 1** shows a perspective front view on a plank panel of combined face plates and fasteners.
- Fig. 2A** is a perspective back view of the plank panel and fasteners of **Fig. 1**.
- Fig. 2B** is an enlarged detail view indicated in **Fig. 2A** by numeral 121.
- 10 **Fig. 3** is an enlarged perspective view of the fastener of **Figs. 1, 2A**.
- Fig. 4** is a side view of a single face plate and the fasteners of **Fig. 1**.
- Fig. 5A** shows two face plates in a first bent position during face plate separation.
- 15 **Fig. 5B** is an enlarged detail view indicated in **Fig. 5A** by numeral 121.
- Fig. 6A** shows the two face plates of **Fig. 5A** in a second bent position during face plate separation.
- 20 **Fig. 6B** is an enlarged detail view indicated in **Fig. 6A** by numeral 121.
- Fig. 7** shows the two face plates of **Fig. 5A** immediately after face plate separation.

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DETAILED DESCRIPTION

Referring to **Figs. 1** and **2**, a blank panel **1** includes preferably three face plates **10** separable combined along break-off grooves **121** extending between two opposing side surfaces **16**. The face plates **10** have contact faces **13** on opposing ends and adjacent the side surfaces **16**. The contact faces **13** are separated by reinforcement ribs **55**. The contact

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faces 13 are substantially planar along a first width 131. The reinforcement ribs 55 extend along the second width 551.

From preferably each of the side surfaces 16 extend inward along the contact faces 13 two finite channels 25 featuring overhead extensions 30. The channels 25 are defined in combination with the overhead extensions 30 to exchangably and slidably hold correspondingly shaped mating structures 61.

The contact faces 13 may additionally feature positioning indicators 52 for indicating a predetermined position for the fasteners 60 with their mating structures 61. As an advantageous result, fasteners 60 may be brought into appropriate position along channels 25 prior to attachment of the face plates 10 and/or blank panel 1.

Referring to **Fig. 2B**, the break-off groove 121 includes a thin film bridge 125 structurally exclusive connecting two adjacent face plates 10. Positioned in a groove angle **GA** and oppositely of the thin film bridge 125 are levering faces 126 for inducing a tension force onto the thin film bridge 125 at and in excess of a break-off bending angle **B2** (see **Fig. 6B**) imposed on two adjacent face plates 10 preferably during manual face plate separation.

The mating structure 61 is part of the fastener 60 further illustrated in **Figs. 3** and **4**. The fastener 60 has at least two laterally resilient protrusions 65 extending substantially symmetrically with respect to an attachment axis 69. The attachment axis 69 is substantially perpendicular with respect to a contact face 13 while the mating structure 61 is held in a corresponding channel 25.

The protrusions 65 preferably feature straddle lags 651 that extend away from the mating structure 61 in an straddle angle 652 such that the resilient protrusions 65 induce a pulling force via the straddle legs 651, the column 62 and the mating structure 61 on the associated face plate 10, while the resilient protrusions 65 are inserted in an orifice hole 4 of the mounting bar 3. As a favorable result, the blank panel 1 and/or face plate 10 is forced with the associated contact face 13 against the mounting bar 3, while the fastener additionally holds the blank panel 1 and/or face plate 10 in position. In Fig. 4, mounting bar 3 and orifice hole 4 are indicated in dotted lines.

Front surfaces 12 of the face plates 10 may be fabricated with a slight curvature in direction across the main protrusion direction of the blank panel 1, which provides for a smooth thickness reduction of the main plate bodies towards the intersections. In that manner, the main plate bodies may be fabricated with sufficient strength along the main protrusion direction to sufficiently oppose torsion deformation resulting during the preferably manual face plate separation. At the same time, the height of the intersections 121 may be kept to a minimum, providing a maximum leverage effect and consequently maximum tension load from a given torque preferably manually induced at some point along the protrusion direction of the blank panel 1.

The lateral resilient protrusions 65 may further include parallel legs 652 and converging legs 653 terminating in a single closed tip. In that way, the protrusions 65 may provide a certain self centering action when approached to the predetermined orifice hole 4. The parallel legs 652 may assist in adjusting the protrusions 65 deformation behavior and reduce peak stresses by providing sufficient deformation

length of the protrusions 65 as may be well appreciated by anyone skilled in the art. Preferably two but also three or more lateral resilient protrusions 65 may be concentrically arrayed around the attachment axis 69.

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The intersection 121 is configured to provide sufficient stiffness to the blank panel 1 and at the same time warrant limited opposition to a manual face plate 10 separation, which may be performed in a two step process. During a first bent indicated in Fig. 5A, two adjacent face plates 10 are bent in an angle B1 with the front faces 12 towards each other. During the initial first bend, the thin film bridge 125 is excessively deformed after overcoming its natural stiffness. During a consecutive second bend indicated in Fig. 6A, the two involved face plates 10 are bent in an angle B2 in opposite direction with the reinforcement ribs 55 towards each other. At the moment when the second bend angle B2 approximately exceeds the groove angle GA, the levering faces 126 contact and become forced against each other as the second bend angle B2 is further increased. This results in a tensile load on the previously weakened thin film bridge 125, which eventually spontaneously rips, completely separating the two adjacent face plates 10 as illustrated in Fig. 7.

The blank panel 1 is preferably monolithically fabricated by injection molding. A preferred polymer material is a well known ABS with optional contents of glass or other stiffening fibers. The fiber contents may be adjusted in conjunction with the dimensions of thin film bridge 125 and groove angle GA to warrant instantaneous and complete separation as may be well appreciated by anyone skilled in the art.

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Accordingly, the scope of the invention should be determined by the following claims and their legal equivalents.